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321	7590	11/13/2006	EXAMINER	
SENNIGER POWERS ONE METROPOLITAN SQUARE 16TH FLOOR ST LOUIS, MO 63102			DAHIMENE, MAHMOUD	
			ART UNIT	PAPER NUMBER
			1765	

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Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/665,982

Applicant(s)

ERK ET AL.

Examiner

Mahmoud Dahimene

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 28 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-99 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-99 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-22, 26-28, 33-78, 82-87, 89, and 91-99 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ionue et al. (U.S. Patent Appl. Pub. No. 2001/0003672).
3. As to claim 1, Ionue discloses an etching process for removing silicon from the surface of a silicon wafer (paragraph 0015), the process comprising contacting the surface of the silicon wafer with a caustic etchant (paragraphs 0069-0075) in the form of an aqueous solution comprising water and a source of hydroxide ions (paragraphs 0015, 0023).
4. Ionue does not expressly disclose that the concentration of water in the caustic etchant being less than 45% by weight in a single embodiment. However, Ionue discloses that the concentration of alkali metal hydroxide is up to 30% by weight (paragraph 030). Moreover, Ionue teaches that as the amount of the alkali metal hydroxide is increased, the polishing removal rate also increases ("[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount

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increases, the polishing removal rate becomes high...,” paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also increases, paragraph 0081). Thus, one who is skilled in the art who desires a higher polishing removal rate would use a of alkali metal hydroxide of about 30% by weight, the higher end of Ionue’s disclosed range (paragraph 030). It should further be noted that Ionue’s disclose of an alkali metal hydroxide up to 30% by weight is not limited by the preferred embodiments (“it should be understood that the present invention is by no means restricted to such specific Examples”) (paragraph 0062).

5. Additionally, Ionue discloses that the concentration of abrasive is up to 50% by weight (paragraph 049). Ionue further teaches that the concentration of abrasive is related to the polishing removal rate (“[i]f the content of the abrasive is too small, the polishing removal rate will be low... On the other hand, if it is too large, uniform dispersion tends to be hardly maintained, paragraph 0049). Thus, one who is skilled in the art who desires a higher polishing removal rate would use a concentration of abrasive of about 50% by weight (paragraph 049), the higher end of Ionue’s disclosed range. It should further be noted that Ionue’s disclose of a concentration of abrasive of up to 50% by weight is not limited by the preferred embodiments (“it should be understood that the present invention is by no means restricted to such specific Examples”) (paragraph 0062).

6. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of abrasive up to 50% by weight and a concentration of alkali metal hydroxide up to

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30% by weight. As a result, the concentration of water can be as low as 20% by weight, (or a concentration of water being less than 45% by weight). One who is skilled in the art would be motivated to increase the polishing rate of the wafer.

7. As to claim 2, Ionue suggests that the concentration of water in the caustic etchant is at least about 10% by weight, as discussed in the rejection of claim 1.

8. As to claim 3, Ionue suggests that the concentration of water in the caustic etchant is at least about 20% by weight, as discussed in the rejection of claim 1.

9. As to claim 4, Ionue suggests that the concentration of water in the caustic etchant is at least about 25% by weight, as discussed in the rejection of claim 1.

10. As to claim 5, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 42% by weight, as discussed in the rejection of claim 1.

11. As to claim 6, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 37% by weight, as discussed in the rejection of claim 1.

12. As to claim 7, Ionue does not expressly disclose that the concentration of the source of hydroxide ions in the caustic etchant is greater than 55% by weight.

However, Ionue teaches that as the amount of the alkali metal hydroxide is increased, the polishing removal rate also increases (“[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high...,” paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also

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increases, paragraph 0081). Moreover, Ionue teaches, by disclosing that the alkali metal hydroxide concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05

(II)(B). Alkali metal hydroxide concentration can be varied accordingly, depending on the desired outcome of the polishing step, such as a high polishing removal rate.

Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the concentration of the source of hydroxide ions in the caustic etchant greater than 55% by weight. One who is skilled in the art would be motivated to optimize polishing removal rate through routine experimentation of alkali metal hydroxide concentrations. See MPEP § 2144.05 (II)(B).

13. As to claim 8, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is at least about 58% by weight, as discussed in the rejection of claim 7.

14. As to claim 9, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is at least about 58% by weight, as discussed in the rejection of claim 7.

15. As to claim 10, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is at least about 62% by weight, as discussed in the rejection of claim 7.

16. As to claim 11, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is at least about 65% by weight, as discussed in the rejection of claim 7.

17. As to claim 12, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is no more than about 75% by weight, as discussed in the rejection of claim 7.

18. As to claim 13, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is from about 58% to about 70% by weight, as discussed in the rejection of claim 7.

19. As to claim 14, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is from about 58% to about 65% by weight, as discussed in the rejection of claim 7.

20. As to claim 15, Ionue suggests that the alkali metal hydroxide the concentration of the source of hydroxide ions in the caustic etchant is from about 62% to about 65% by weight, as discussed in the rejection of claim 7.

21. As to claim 16, Ionue discloses that the source of hydroxide ions comprises an alkali metal hydroxide selected from the group consisting of sodium hydroxide and potassium hydroxide (paragraph 0023).

22. As to claim 17, Ionue discloses that the caustic etchant further comprises a salt additive (paragraphs 0015, 0024).

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23. As to claim 18, Ionue discloses that the salt additive is selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof (paragraphs 0015, 0024).

24. As to claim 19, Ionue discloses that the salt additive comprises a compound selected from the group consisting of potassium fluoride and potassium carbonate (paragraph 0024).

25. As to claim 20, Ionue discloses that the concentration of the salt additive ("alkali metal...carbonate") in the caustic etchant is no more than about 25% by weight (paragraphs 0031, 0024).

26. As to claim 21, Ionue discloses that the concentration of the salt additive ("alkali metal...carbonate") in the caustic etchant is from about 5% to about 25% by weight (paragraphs 0031, 0024).

27. As to claim 22, Ionue does not expressly discloses that the concentration of the source of hydroxide ions in the caustic etchant is greater than 55% by weight.

However, Ionue teaches that as the amount of the alkali metal hydroxide (or hydroxide ions) is increased, the polishing removal rate also increases ("[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high....," paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also increases, paragraph 0081). Moreover, Ionue teaches, by disclosing that the alkali metal hydroxide (or hydroxide ions) concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See



MPEP § 2144.05 (II)(B). Alkali metal hydroxide concentration can be varied accordingly, depending on the desired outcome of the polishing step, such as a high polishing removal rate. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the concentration of the source of hydroxide ions in the caustic etchant greater than 55% by weight. One who is skilled in the art would be motivated to optimize polishing removal rate through routine experimentation of alkali metal hydroxide concentrations. See MPEP § 2144.05 (II)(B).

28. As to claim 26, Ionue does not expressly disclose that the surface of the wafer is contacted with the caustic etchant by immersing the wafer in the caustic etchant. However, Ionue discloses a chemical mechanical polishing of the wafers with the caustic etchant (paragraphs 0067-0075). Thus, the surface of the wafer is inherently contacted with the caustic etchant by immersing the wafer in the caustic etchant during chemical mechanical polishing. See Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002) ("Wolf IV"), pages 322-324.

29. As to claim 27, Ionue discloses that the wafer is rotated while immersed in the caustic etchant (paragraph 0071).

30. As to claim 28, Ionue discloses that the rate of rotation of the wafer immersed in the caustic etchant is from about 1 revolution per minute to about 100 revolutions per minute (paragraph 0071).

31. As to claim 33, Ionue discloses an etching process for removing silicon from the surface of a silicon wafer, the process comprising contacting the surface of the silicon

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wafer with a caustic etchant in the form of an aqueous solution comprising water and a source of hydroxide ions (paragraph 0015, 0021, 0023).

32. Ionue does not expressly disclose that the concentration of the source of hydroxide ions in the caustic etchant being greater than 55% by weight. However, Ionue teaches that as the amount of the alkali metal hydroxide (or hydroxide ions) is increased, the polishing removal rate also increases (“[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high...,” paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also increases, paragraph 0081). Moreover, Ionue teaches, by disclosing that the alkali metal hydroxide (or hydroxide ions) concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II)(B). Alkali metal hydroxide concentration can be varied accordingly, depending on the desired outcome of the polishing step, such as a high polishing removal rate. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the concentration of the source of hydroxide ions in the caustic etchant greater than 55% by weight. One who is skilled in the art would be motivated to optimize polishing removal rate through routine experimentation of alkali metal hydroxide concentrations. See MPEP § 2144.05 (II)(B).

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33. As to claim 34, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is at least about 58% by weight, as discussed in the rejection of claim 33.

34. As to claim 35, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is at least about 60% by weight, as discussed in the rejection of claim 33.

35. As to claim 36, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is at least about 62% by weight, as discussed in the rejection of claim 33.

36. As to claim 37, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is at least about 65% by weight, as discussed in the rejection of claim 33.

37. As to claim 38, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is no more than about 75% by weight, as discussed in the rejection of claim 33.

38. As to claim 39, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is from about 58% to about 70% by weight, as discussed in the rejection of claim 33.

39. As to claim 40, lonue suggests that the concentration of the source of hydroxide ions in the caustic etchant is from about 58% to about 65% by weight, as discussed in the rejection of claim 33.

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40. As to claim 41, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is from about 62% to about 65% by weight, as discussed in the rejection of claim 33.

41. As to claim 42, Ionue discloses that the source of hydroxide ions comprises an alkali metal hydroxide selected from the group consisting of sodium hydroxide and potassium hydroxide (paragraph 0023).

42. As to claim 43, Ionue discloses that the source of hydroxide ions comprises sodium hydroxide (paragraph 0023).

43. As to claim 44, Ionue suggests that the concentration of sodium hydroxide in the caustic etchant is at least about 58% by weight, as discussed in the rejection of claim 33.

44. As to claim 45, Ionue suggests that the concentration of sodium hydroxide in the caustic etchant is at least about 62% by weight, as discussed in the rejection of claim 33.

45. As to claim 46, Ionue suggests that the concentration of sodium hydroxide in the caustic etchant is no more than about 68% by weight, as discussed in the rejection of claim 33.

46. As to claim 47, Ionue suggests that the concentration in the caustic etchant is from about 58% to about 68% by weight, as discussed in the rejection of claim 33.

47. As to claim 48, Ionue suggests that the concentration of sodium hydroxide in the caustic etchant is from about 61% to about 63% weight, as discussed in the rejection of claim 33.

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48. As to claim 49, Ionue suggests that the concentration of sodium hydroxide in the caustic etchant is from about 61% to about 63% weight, as discussed in the rejection of claim 33.

49. As to claim 50, Ionue discloses that the source of hydroxide ions comprises potassium hydroxide (paragraph 0023).

50. As to claim 51, Ionue suggests that the concentration of potassium hydroxide in the caustic etchant is at least about 57% by weight, as discussed in the rejection of claim 33.

51. As to claim 52, Ionue suggests that the concentration of potassium hydroxide in the caustic etchant is at least about 60% by weight, as discussed in the rejection of claim 33.

52. As to claim 53, Ionue suggests that the concentration of potassium hydroxide in the caustic etchant is no more than about 63% by weight, as discussed in the rejection of claim 33.

53. As to claim 54, Ionue suggests that the concentration of potassium hydroxide in the caustic etchant is from about 57% to about 63% by weight, as discussed in the rejection of claim 33.

54. As to claim 55, Ionue suggests that the concentration of potassium hydroxide in the caustic etchant is from about 60% to about 63% by weight, as discussed in the rejection of claim 33.

55. As to claim 56, Ionue suggests that concentration of water in the caustic etchant is at least about 20% by weight, as discussed in the rejection of claim 1.

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56. As to claim 57, Ionue suggests that the concentration of water in the caustic etchant is at least about 25% by weight, as discussed in the rejection of claim 1.

57. As to claim 58, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 42% by weight, as discussed in the rejection of claim 1.

58. As to claim 59, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 37% by weight, as discussed in the rejection of claim 1.

59. As to claim 60, Ionue discloses that the caustic etchant further comprises a salt additive, the salt additive comprising a compound selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof (paragraphs 0015, 0024).

60. As to claim 61, Ionue discloses that the concentration of salt additive ("alkali metal...carbonate") in the caustic etchant is no more than about 25% by weight (paragraphs 0031, 0024).

61. As to claim 62, Ionue discloses that the concentration of salt additive ("alkali metal...carbonate") in the caustic etchant is from about 5% to about 25% by weight (paragraphs 0031, 0024).

62. As to claim 63, Ionue discloses an etching process for removing silicon from the surface of a silicon wafer, the process comprising contacting the surface of the silicon wafer with a caustic etchant in the form of an aqueous solution comprising water and a source of hydroxide ions (paragraph 0015, 0021, 0023).

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63. Ionue does not expressly disclose that the concentration of the source of hydroxide ions in the caustic etchant being at least about 70% of the saturation concentration of the source of hydroxide ions in the caustic etchant. However, Ionue teaches that as the amount of the alkali metal hydroxide (or hydroxide ions) is increased, the polishing removal rate also increases ("[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high...", paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also increases, paragraph 0081). Moreover, Ionue teaches, by disclosing that the alkali metal hydroxide (or hydroxide ions) concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II)(B). Alkali metal hydroxide concentration can be varied accordingly, depending on the desired outcome of the polishing step, such as a high polishing removal rate. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of the source of hydroxide ions in the caustic etchant being at least about 70% of the saturation concentration of the source of hydroxide ions in the caustic etchant. One who is skilled in the art would be motivated to optimize polishing removal rate through routine experimentation of alkali metal hydroxide concentrations. See MPEP § 2144.05 (II)(B).

64. As to claim 64, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is at least about 74% of the saturation concentration of the

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source of hydroxide ions in the caustic etchant, as discussed in the rejection of claim 63.

65. As to claim 65, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is less than about 95% of the saturation concentration of the source of hydroxide ions in the caustic etchant, as discussed in the rejection of claim 63.

66. As to claim 66, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is less than about 95% of the saturation concentration of the source of hydroxide ions in the caustic etchant, as discussed in the rejection of claim 63.

67. As to claim 67, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is from about 74% to about 90% of the saturation concentration of the source of hydroxide ions in the caustic etchant, as discussed in the rejection of claim 63.

68. As to claim 68, Ionue suggests that the concentration of the source of hydroxide ions in the caustic etchant is from about 74% to about 81% of the saturation concentration of the source of hydroxide ions in the caustic etchant, as discussed in the rejection of claim 63.

69. As to claim 69, Ionue discloses that the source of hydroxide ions comprises an alkali metal hydroxide selected from the group consisting of sodium hydroxide and potassium hydroxide (paragraph 0023).



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70. As to claim 70, Ionue discloses that the source of hydroxide ions comprises sodium hydroxide (paragraph 0023).

71. As to claim 71, Ionue discloses that the source of hydroxide ions comprises potassium hydroxide (paragraph 0023).

72. As to claim 72, Ionue discloses that the caustic etchant further comprises a salt additive, the salt additive comprising a compound selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof (paragraphs 0015, 0024).

73. As to claim 73, Ionue discloses that the concentration of salt additive ("alkali metal...carbonate") in the caustic etchant is no more than about 25% by weight (paragraphs 0031, 0024).

74. As to claim 74, Ionue discloses that the concentration of salt additive ("alkali metal...carbonate") in the caustic etchant is from about 5% to about 25% by weight (paragraphs 0031, 0024).

75. As to claim 75, Ionue suggests that concentration of water in the caustic etchant is at least about 20% by weight, as discussed in the rejection of claim 1.

76. As to claim 76, Ionue suggests that the concentration of water in the caustic etchant is at least about 25% by weight, as discussed in the rejection of claim 1.

77. As to claim 77, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 42% by weight, as discussed in the rejection of claim 1.

78. As to claim 78, Ionue suggests that the concentration of water in the caustic etchant is from about 30% to about 37% by weight, as discussed in the rejection of claim 1.

79. As to claim 82, Ionue discloses an etching process for removing silicon from the surface of a silicon wafer (paragraph 0015), the process comprising contacting the surface of the silicon wafer with a caustic etchant (paragraphs 0069-0075) in the form of an aqueous solution comprising water, hydroxide ions, and a salt additive (paragraphs 0015, 0024), the salt additive comprising a compound selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof (paragraph 0024).

80. Ionue does not expressly disclose that the concentration of the salt additive in the caustic etchant being at least about 4 mole percent in a single embodiment. However, Ionue discloses that the concentration of alkali metal hydroxide is up to 30% by weight. Moreover, Ionue teaches that as the amount of the alkali metal hydroxide is increased, the polishing removal rate also increases (“[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high...,” paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also increases, paragraph 0081). Thus, one who is skilled in the art who desires a higher polishing removal rate would use a of alkali metal hydroxide of about 30% by weight, the higher end of Ionue’s disclosed range (paragraph 030). It should further be noted that Ionue’s disclose of an alkali metal hydroxide up to 30% by weight is not

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limited by the preferred embodiments ("it should be understood that the present invention is by no means restricted to such specific Examples") (paragraph 0062).

81. Additionally, Ionue discloses that the concentration of salt additive (paragraph 0023) is up to 30 weight percent (paragraph 0031). Ionue teaches that the additive functions to accelerate the polishing by chemical action (paragraph 0021). Moreover, Ionue teaches, by disclosing that the salt additive concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II)(B). Salt additive concentration can be varied accordingly, depending on the desired outcome of the polishing step, to achieve the desired amount of polish acceleration through chemical action. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of salt additive up to 30 weight percent. One who is skilled in the art would be motivated to optimize polish acceleration through chemical action through routine experimentation of salt additive concentrations. See MPEP § 2144.05 (II)(B).

82. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration mixture of about 50% by weight water (molar mass = 18 g/mole), about 30% by weight sodium hydroxide (molar mass = 40 g/mole), and about 20% by weight potassium carbonate (molar mass = 138 g/mole). In other words, there is a suggestion that both the concentration of sodium hydroxide and potassium carbonate are results-effective variables. This mixture yields a water concentration of about 75 mole percent, a sodium

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hydroxide concentration of about 20 mole percent, and a potassium carbonate concentration of about 5 mole percent.

83. Ionue does not expressly disclose that the salt additive does not decompose or react in the caustic etchant. However, because Applicant's caustic etchant contains the same components as Ionue's etchant (paragraphs 0015, 0023, 0024), one who is skilled in the art would expect the salt additive does not decompose or react in the caustic etchant.

84. As to claim 83, Ionue suggests that the concentration of the salt additive in the caustic etchant is at least about 5 mole percent, as discussed in the rejection of claim 82. A mixture of 50% by weight water, a small amount of sodium hydroxide, and about 50% by weight potassium carbonate yields a potassium carbonate concentration of about 11 mole percent.

85. As to claim 84, Ionue suggests that the concentration of the salt additive in the caustic etchant is at least about 10 mole percent, as discussed in the rejection of claim 83.

86. As to claim 85, Ionue suggests that the concentration of the salt additive in the caustic etchant is from about 4 to about 15 mole percent, as discussed in the rejection of claim 82.

87. As to claim 86, Ionue discloses that the salt additive comprises an inorganic sodium or potassium salt (paragraph 0024).

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88. As to claim 87, Ionue discloses that the salt additive comprises an inorganic salt selected from the group consisting of potassium carbonate (paragraph 0024) and sodium carbonate (paragraph 0024).

89. As to claim 89, Ionue discloses that the salt additive comprises potassium carbonate (paragraph 0024).

90. As to claim 91, Ionue suggests that the concentration of hydroxide ions in the caustic etchant is no more than about 20 mole percent, as discussed in the rejection of claim 82.

91. As to claim 92, Ionue suggests that the concentration of hydroxide ions in the caustic etchant is no more than about 15 mole percent, as discussed in the rejection of claim 82.

92. As to claim 93, Ionue suggests that the concentration of hydroxide ions is from about 10 to about 15 mole percent, as discussed in the rejection of claim 82.

93. As to claim 94, Ionue suggests that the concentration of water in the caustic etchant is no more than about 85 mole percent, as discussed in the rejection of claim 82.

94. As to claim 95, Ionue suggests that the concentration of water in the caustic etchant is from about 70 to about 85 mole percent, as discussed in the rejection of claim 82.

95. As to claim 96, Ionue suggests that the concentration of water in the caustic etchant is from about 75 to about 85 mole percent, as discussed in the rejection of claim 82.

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96. As to claim 97, Ionue does not expressly disclose that the pH of the caustic etchant is at least about 13. However, the pH of sodium hydroxide solutions is inherently greater than 12. See ClearTech Technical Department, ClearTech Industries, Sodium Hydroxide Solutions MSDS (2001).

97. As to claim 98, Ionue does not expressly disclose that the pH of the caustic etchant is from about 13.9 to about 14. However, the pH of sodium hydroxide solutions is inherently greater than 12. See ClearTech Technical Department, ClearTech Industries, Sodium Hydroxide Solutions MSDS (2001).

98. As to claim 99, Ionue discloses an etching process for removing silicon from the surface of a silicon wafer (paragraph 0015), the process comprising contacting the surface of the silicon wafer with a caustic etchant (paragraphs 0069-0075) in the form of an aqueous solution comprising water, hydroxide ions, and a salt additive (paragraphs 0015, 0024) the salt additive comprising a compound selected from the group consisting of potassium carbonate and potassium fluoride (paragraph 0024).

99. Ionue does not expressly disclose that the concentration of the salt additive in the caustic etchant being at least about 4 mole percent in a single embodiment. However, Ionue discloses that the concentration of alkali metal hydroxide is up to 30% by weight. Moreover, Ionue teaches that as the amount of the alkali metal hydroxide is increased, the polishing removal rate also increases (“[w]hen such an additive is used for a polishing composition, there is a tendency that as the amount increases, the polishing removal rate becomes high...,” paragraph 0032; TABLE 1, Ex. 1 to Ex. 6 demonstrates that when KOH/NaOH concentration is increased, polishing removal rate also

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increases, paragraph 0081). Thus, one who is skilled in the art who desires a higher polishing removal rate would use a of alkali metal hydroxide of about 30% by weight (or a sodium hydroxide concentration of about 20 mole percent), the higher end of Ionue's disclosed range (paragraph 030). It should further be noted that Ionue's disclose of an alkali metal hydroxide up to 30% by weight is not limited by the preferred embodiments ("it should be understood that the present invention is by no means restricted to such specific Examples") (paragraph 0062).

100. Additionally, Ionue discloses that the concentration of potassium carbonate (paragraph 0023) is up to 30 weight percent (paragraph 0031). Ionue teaches that the additive functions to accelerate the polishing by chemical action (paragraph 0021). Moreover, Ionue teaches, by disclosing that the potassium carbonate concentration may be varied, that changing the concentration appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II)(B). Potassium carbonate concentration can be varied accordingly, depending on the desired outcome of the polishing step, to achieve the desired amount of polish acceleration through chemical action. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of potassium carbonate up to 30 weight percent. One who is skilled in the art would be motivated to optimize polish acceleration through chemical action through routine experimentation of potassium carbonate concentrations. See MPEP § 2144.05 (II)(B).

101. Therefore, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration

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mixture of about 50% by weight water (molar mass = 18 g/mole), about 30% by weight sodium hydroxide (molar mass = 40 g/mole), and about 20% by weight potassium carbonate (molar mass = 138 g/mole). In other words, there is a suggestion that both the concentration of sodium hydroxide and potassium carbonate are results-effective variables. This mixture yields a water concentration of about 75 mole percent, a sodium hydroxide concentration of about 20 mole percent, and a potassium carbonate concentration of about 5 mole percent.

102. Ionue does not expressly disclose that the salt additive does not decompose or react in the caustic etchant. However, because Applicant's caustic etchant contains the same components as Ionue's etchant (paragraphs 0015, 0023, 0024), one who is skilled in the art would expect the salt additive does not decompose or react in the caustic etchant.

### ***Claim Rejections - 35 USC § 103***

103. Claims 23-25, 29, and 79-81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ionue, in view of Netsu (U.S. Patent No. 6,099,748).

104. As to claims 23 and 79, Ionue does not expressly disclose that the temperature of the caustic etchant contacted with the silicon wafer is at least about 70°C. However, Netsu discloses a method of etching a silicon wafer, including using a temperature of the caustic etchant (column 2, line 40) contacted with the silicon wafer that is at least about 70°C (column 2, lines 48-49). Netsu further teaches that etching with the caustic etchant at a temperature range of 65°C to 85°C results in an appropriate etching rate.



Moreover, too low of an etching rate impairs productivity, whereas too high of an etching rate results in adverse surface effects (column 2, lines 50-54).

105. As to claims 24 and 80, Netsu discloses that the temperature of the caustic etchant contacted with the silicon wafer is from about 65°C to 85°C (column 2, lines 48-49). It should be noted that there is overlap between the Applicants' claimed temperature range and Netsu's temperature range. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a temperature of the caustic etchant contacted with the silicon wafer from about 70°C to 120°C. One who is skilled in the art would be motivated to use a temperature range that overlaps with a temperature range known to produce desirable silicon etching rates.

106. As to claims 25 and 81, Netsu discloses that the temperature of the caustic etchant contacted with the silicon wafer is from about 75°C to 85°C (column 2, lines 48-49).

107. As to claim 29, Ionue does not expressly disclose that the wafer is immersed in the caustic etchant for a time such that the amount of silicon removed from the surface of the wafer is from about 10  $\mu\text{m}$  to about 30  $\mu\text{m}$  in terms of total thickness from both the front and back surface of the wafer. However, Netsu discloses a method of etching a silicon wafer, including immersing the wafer in the caustic etchant (column 2, line 40) for a time such that the amount of silicon removed from the surface of the wafer is from about 10  $\mu\text{m}$  to about 30  $\mu\text{m}$  in terms of total thickness from both the front and back surface of the wafer (column 2, lines 59-62). Moreover, Netsu teaches that removal of a thickness in this range is required to eliminate mechanical damage (column 2, lines 63-

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67) introduce by mechanically slicing the wafer (column 1, lines 15-25). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to immerse the wafer in the caustic etchant for a time such that the amount of silicon removed from the surface of the wafer is from about 10  $\mu\text{m}$  to about 30  $\mu\text{m}$  in terms of total thickness from both the front and back surface of the wafer. One who is skilled in the art would be motivated to eliminate mechanical damage from the wafer.

***Claim Rejections - 35 USC § 103***

108. Claims 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ionue, in view of Tsung-Kuei et al. (U.S. Patent No. 6,793,836).

109. As to claim 30, Ionue does not expressly disclose that the surface of the wafer is contacted with the caustic etchant by spraying the surface of the wafer with the caustic etchant. However, Tsung-Kuei discloses a method of wet etching, including spraying the surface of the wafer with etchant (column 1, lines 47-55; column 2, lines 55-57; Figure 1). Tsung-Kuei teaches that spray and spin etching is a commonly used wet etching technique for silicon (column 1, lines 13-18) that provides for more uniform etching (column 1, lines 35-36). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to contact the surface of the wafer with the caustic etchant by spraying the surface of the wafer with the caustic etchant. One who is skilled in the art would be motivated to use a commonly used wet etching technique for silicon that provides for more uniform etching.

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110. As to claim 31, Tsung-Kuei discloses that the wafer is rotated while the surface of the wafer is sprayed with the etchant (column 1, lines 47-55).

111. As to claim 32, Tsung-Kuei discloses that the rate of rotation of the wafer is from about 50 revolutions per minute to about 650 revolutions per minute (column 2, lines 9-16).

***Claim Rejections - 35 USC § 103***

112. Claim 88 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ionue, in view of Fruitman (U.S. Patent No. 5,769,691), in further view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002).

113. As to claim 88, Ionue does not expressly disclose that the salt additive comprises potassium fluoride. However, Fruitman discloses an etching process, including an abrasive slurry containing potassium fluoride as a suitable additive for oxidation purposes (column 3, lines 42-62). Wolf teaches that when polishing bare silicon wafers, the silicon surface must first be oxidized prior to the mechanical removal of the oxide (page 336). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include potassium fluoride. One who is skilled in the art would be motivated to use a suitable etching additive for oxidation purposes.

***Claim Rejections - 35 USC § 103***

114. Claim 90 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ionue, in view of Fruitman (U.S. Patent No. 5,769,691), in view of Kuramochi et al. (U.S. Patent No. 6,361,403).

115. As to claim 90, Ionue does not expressly disclose that the salt additive comprises an inorganic alkali metal or alkaline earth metal salt hydrate. However, Kuramochi discloses polishing process, including an abrasive slurry containing alkali metal salt hydrides (column 4, lines 38-48). Kuramochi further teaches that the additives, including alkali metal salt hydrides, function to enhance the rate of polishing (column 4, lines 62-65). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made include an inorganic alkali metal hydrate. One who is skilled in the art would be motivated to enhance the rate of polishing.

***Response to Arguments***

1. Applicant's arguments filed on 08/28/2006 have been fully considered but they are not persuasive.

2. In response to applicant's arguments regarding claim 1 (page 1-7), it is maintained that in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of abrasive up to 50% by weight and a concentration of alkali metal hydroxide up to

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30% by weight. As a result, the concentration of water can be as low as 20% by weight, (or a concentration of water being less than 45% by weight). One who is skilled in the art would be motivated to increase the polishing rate of the wafer. In response to applicant's arguments, it is maintained that a specific example showing both an abrasive concentration of 50% and a hydroxide concentration of 30% is not needed to render such a combination obvious. Preferred embodiments do not exclude other embodiments encompassed by the broad disclosure of Ionue since the effect of higher hydroxide concentration and higher abrasive concentration are known to increase the polishing removal rate (paragraph 0032; and Table 1). The amount of hydroxide and abrasive is considered optimizable, the higher end of the disclosed ranges for those components of the mixture can be used willing to accept a degree of surface roughening and low dispersion of the abrasive provided for example a second subsequent polishing operation is used as suggested by Ionue (page 3, paragraph 0031), the second polishing operation can be selected to obtain a final smooth surface, while the polishing with the high concentrations allows a fast polishing rate, resulting in a fast polishing rate and smooth final surface which is desirable. Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments SEE MPEP § 2123 (II).

3. In response to applicant's arguments regarding claims 33 and 63, it is maintained that , it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the concentration of the source of hydroxide ions in the caustic etchant greater than 55% or 70% by weight. One who is skilled in the art would

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be motivated to optimize polishing removal rate through routine experimentation of alkali metal hydroxide concentrations. See MPEP § 2144.05 (II)(B). It is maintained that a specific example showing a hydroxide concentration of 55% or 70% is not needed to render such a combination obvious. Preferred embodiments do not exclude other embodiments encompassed by the broad disclosure of Inoue since the effect of higher hydroxide concentration is known to increase the polishing removal rate. The amount of hydroxide is considered optimizable, the higher end of the disclosed ranges for those components of the mixture can be used willing to accept a degree of surface roughening and low dispersion of the abrasive provided for example a second subsequent polishing operation is used as suggested by Inoue (page 3, paragraph 0031), the second polishing operation can be selected to obtain a final smooth surface, while the polishing with the high concentrations allows a fast polishing rate, resulting in a fast polishing rate and smooth final surface which is desirable.

116. as to claims 82 and 99, regarding applicant's remark that Inoue does not contemplate the use of more than one of these additives in the disclosed composition. Inoue discloses "Such an additive is required to be dissolved in the composition. These additives may be used in combination in optional proportions within a range not impair the effects of the present invention. The content of such an additive in the composition of the present invention, varies depending upon the type of the compound used or the purpose of the composition, but it is usually from 0.001 to 50 wt %, based on the total weight of the composition" (page 2, paragraph 0029). It is maintained that in the absence of unexpected results, it would have been obvious to one of ordinary skill in the

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art at the time the invention was made to use a concentration of salt additive up to 30 weight percent. One who is skilled in the art would be motivated to optimize polish acceleration through chemical action through routine experimentation of salt additive concentrations. See MPEP § 2144.05 (II)(B), and in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration mixture of about 50% by weight water (molar mass = 18 g/mole), about 30% by weight sodium hydroxide (molar mass = 40 g/mole), and about 20% by weight potassium carbonate (molar mass = 138 g/mole). In other words, there is a suggestion that both the concentration of sodium hydroxide and potassium carbonate are results-effective variables. This mixture yields a water concentration of about 75 mole percent, a sodium hydroxide concentration of about 20 mole percent, and a potassium carbonate concentration of about 5 mole percent.

117. As to applicant's arguments the proposed combination of references set forth in the rejection of claims 23-25, 29, 79-81, 30-32, 88 and 90 fails to establish a prima facie case of obviousness, obviousness statements have been provided for each of those claims including motivations based on the knowledge of one of ordinary skill in the art.

### ***Conclusion***

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahmoud Dahimene whose telephone number is (571) 272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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MD

**NADINE G. NORTON**  
**SUPERVISORY PATENT EXAMINER**

